



UNITED STATES MARINE CORPS SCIENCE AND TECHNOLOGY HANDBOOK

MISSIONS / ROLES / FUNCTIONS



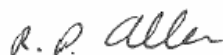
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PREFACE

The Marine Corps develops and executes a Science and Technology (S&T) Program designed to provide technologies that enable the Marine Corps of the future, but retains enough flexibility to also enhance near-term Marine Corps warfighting capabilities. An objective of the S&T program is to develop the technologies necessary to provide Marine Forces with the capabilities to perform those specified and implied missions assigned by law. An additional objective is to present the Combat Development Process with technology opportunities which define the "Art of the Possible." The technology is then available for fielding in order to meet the requirements of the Expeditionary Force Development System (EFDS).

The process for developing the Marine Corps S&T Strategic Plan is integrated with the EFDS. The objectives of the Strategic Plan are driven by the Marine Air-Ground Task Force (MAGTF) Capabilities List (MCL). The MCL is a prioritized list of warfighting gaps and shortfalls and provides the execution, guidance and direction to achieve the goals of the Marine Corps in the near, mid, and far term. The warfighting gaps listed in the MCL provide the basis for the S&T Objectives (STO) presented in the Marine Corps Strategic Plan. The S&T Integrated Process Team (IPT), using the STOs, along with input from the Marine Corps Warfighting Laboratory (MCWL), Office of Naval Research (ONR), Marine Corps Systems Command (MCSC), Marine Corps Program Executive Officer for Land Systems (PEO (LS)), and industry, will identify on-going programs and technologies to determine which requirements are currently being addressed and which require either additional effort, or initiation of S&T development. Based on this information, the IPT will formulate the S&T Strategic Plan. This process educates the Marine Corps S&T program and helps ensure we apply our scarce resources to develop the appropriate technologies for the Marine of tomorrow.

This Handbook has been developed jointly by the Marine Corps Warfighting Laboratory and the Office of Naval Research (ONR 30) *as a guide* for personnel assigned responsibilities relevant to Marine Corps Science and Technology. Inquiries regarding this Handbook should be addressed to the Commander, MCWL (Technology Director) Quantico, Virginia 22134-5096



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PART I: MARINE CORPS SCIENCE & TECHNOLOGY

I. Objective. The objective of Marine Corps S&T is to develop the technology needed to provide the Operating Forces (today's Marine Corps and the Marine Corps After Next) the capabilities to complete their mission. The end product is then available for fielding to meet the requirements of the Expeditionary Force Development System (EFDS).

II. Guidance. Guidance for the operation of Marine Corps S&T is received from the Legislative Act Goldwater-Nichols, Department of Defense (DoD), Department of the Navy (DoN), and Headquarters, Marine Corps.

A. Legislative Act. The Goldwater Nichols Act assigns to the Secretary of the Navy (SECNAV) the sole responsibility for the function of research and development. SECNAV further delegated the oversight of that responsibility to the Assistant Secretary of the Navy (Research, Development and Acquisition (ASN (RDA))), and to the Chief of Naval Research.

Goldwater Nichols assigns the responsibility for requirements to the Chief of Naval Operations (CNO) and the Commandant of the Marine Corps (CMC).

The Secretary of the Navy has assigned to the Office of the Chief of Naval Operations, the responsibility for the function test and evaluation. The Marine Corps Operational Test and Evaluation Agency (MCOTEA) has the responsibility for test and evaluation of Marine Corps Systems Command Programs of Record (POR).

B. DoD Guidance. DoD provides guidance in the series of DoD S&T Planning documents. This series includes:

1. Defense Science and Technology Strategy: Focuses on four generic considerations that have high priority in making strategic decisions about which technologies are pursued:

- a. Affordability
- b. Dual Use
- c. Accelerated Transition
- d. Strong Technology Base

2. Basic Research Plan (BRP): Presents the DoD objectives and investment strategy for DoD-sponsored Basic Research (6.1) performed by universities, industry, and service laboratories. (Note: The Marine Corps has no 6.1 funds and therefore no responsibility for Basic Research.)

3. Joint Warfighting Science and Technology Plan (JSWTP). Provides a joint perspective horizontally across the applied Research (6.2) and Advanced Technology Development (6.3) plans of the services and defense agencies to ensure the requisite technology and advanced concepts for superior joint and coalition warfighting are supported.

4. Department of Defense Research and Engineering (DDR&E) Objectives. The DDR&E Objectives consist of “high-level process objectives” and “technical objectives.” These objectives apply to all DoD components conducting research and engineering.

a. Process objectives focus on business practices that will promote identification and fielding of new technologies that can satisfy capability gaps or present opportunities for entirely new capabilities

b. Technical objectives should enable the delivery of specific characteristics.

C. DoN Guidance.

1. Naval Operating Concept for Joint Operations (NOC). The NOC provides the common overarching guidance for the development of future Navy and Marine Corps capabilities and forces in conjunction with Naval Power 21 transformational vision.

2. Naval Power 21. This document provides the vision for the long-term transformation of the Navy and Marine Corps that will allow the services to respond to a changing national security environment. Naval Power 21 fuses the concepts, capabilities, and core competencies expressed in Seapower 21 and Expeditionary Maneuver Warfare.

3. Seapower 21. Provides the vision on how the Navy will organize, integrate, and transform as it enters the 21st century.

4. DoN S&T Corporate Board. This Board is composed of the Vice Chief of Naval Operations (VCNO), Assistant Commandant of the Marine Corps (ACMC), and the Assistant Secretary of the Navy (Research, Development, & Acquisition (ASN (RDA))). Its purpose is to oversee the DoN S&T program and to issue DoN Strategic Guidance to support the Planning, Programming, Budgeting, and Execution process.

5. Naval S&T Strategic Plan. Developed by the Office of Naval Research, this document identifies thirteen Naval S&T focus areas and provides the basis for the development of ONR’s S&T investment strategy.

D. Marine Corps Guidance.

1. MAGTF Capability List (MCL). The Commandant's Planning Guidance (CPG) is applied to the Expeditionary Maneuver Warfare (EMW) Capability List (ECL) to arrive at a prioritized list of warfighting gaps and shortfalls identified in the Functional Needs Analysis (FNA). This prioritized list is the MCL and it is used as a basis for the Marine Corps S&T Strategic Plan.

2. Marine Corps Science and Technology Strategic Plan. The Strategic Plan provides the S&T Strategy for the Marine Corps Science and Technology enterprise. The Plan guides the priority of the Marine Corps S&T investments and efforts to pursue S&T developmental initiatives and support experimentation of concept-based requirements to achieve

future Marine Corps capabilities. The Plan promulgates Marine Corps Science & Technology Objectives (STO).

E. Marine Corps General Officer / Senior Executive Service Guidance. This guidance provides force structure, capability needs and requirements, and fiscal guidance. The primary sources for this guidance are:

1. Advocates

Advocate	Area of Advocacy
Deputy Commandant for Aviation	Aviation Combat Element
Deputy Commandant for Plans, Programs, and Operations	Ground Combat Element
Deputy Commandant for Installation and Logistics	Logistics Combat Elements/Supporting Establishment
Commanding General, Marine Corps Combat Development Command	Command Element

2. Deputy Commandant, Combat Development & Integration
3. Commanding General, Marine Corps Warfighting Laboratory (MCWL)
4. Department Head, Expeditionary Warfare and Combating Terrorism (Code 30, Office of Naval Research (ONR))

III. Investment Options. The Marine Corps S&T efforts and programs are financed through (1) Green dollars, (2) Blue dollars supporting Naval needs, and (3) Leveraging the investment of other Services and Agencies.

A. Green Dollars. Appropriations controlled directly by the Marine Corps. The Marine Corps programs resources in the RDT&E appropriation for Research, Development, Test & Evaluation.

B. Blue Dollars. Navy S&T resources applied to Naval needs leading to a set of future capabilities. ONR's mission is to plan and execute *Naval* S&T.

C. Leveraging. In light of the Marine Corps comparatively small S&T budget, The Marine Corps needs remain a fixed cost that can only be compensated through a comprehensive awareness of and tangible leverage over the relevant S&T activities of others. Therefore, the Marine Corps strategy must be designed to influence and exploit technologies throughout the U.S. Government, Industry and Academia during all stages of their development.

IV. Funding Categories. An understanding of the execution of Marine Corps S&T requires knowledge of the different funding categories of S&T. The Department of Defense delineates budget activities with specific funding categories for science and technology known as: basic research, applied research, and advanced technology development.

A. Basic Research (6.1) is executed as part of ONR's portfolio and seeks to advance understanding of fundamental aspects of processes and properties. It is not tied to specific Fleet or Force requirements. *Basic research is focused primarily on long term goals leading to new or improved technologies.* Sometimes efforts initiated in the research laboratory produce results that can be transferred rapidly to either military or civilian applications, but in most cases the full impact of scientific research does not become apparent until many years after its initiation. Some basic research never leads to further development and is ultimately "placed on the shelf." The Marine Corps doesn't program or budget any 6.1 funds, but is able to influence basic research through ONR.

B. Applied Research (6.2) is executed at ONR and is the systematic study to understand the means to meet recognized and specific naval needs. Applied research translates promising basic research into solutions for broadly defined military needs, short of system development projects. Its focus is proving technology feasibility when applied to solving military problems.

C. Advanced Technology Development (6.3) is executed at ONR and also at MCWL through Operational Experimentation. 6.3 includes the development of subsystems and components and the efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment. The focus is on demonstrating the military utility of technologies and applying them to acquisition programs. It supports the Future Naval Capabilities (FNC) program, warfighting experimentation conducted by the Marine Corps Warfighting Laboratory, and Innovative Naval Prototypes (INP) program. In addition to 6.3 funds, the INP programs can also utilize 6.2 funds.

1. Future Naval Capabilities. The ONR Future Naval Capability (FNC) program is structured to focus on providing Enabling Capabilities (ECs) to close warfighting gaps. The FNC program provides the best technology solutions to stated OPNAV requirements by bundling discrete but interrelated S&T products that deliver a distinctly measurable improvement within a five-year time frame. The Technical Oversight Group, a three-star Navy and Marine Corps Board of Directors, approves the individual ECs for the FNC program based on their contribution to closing a warfighting capability gap, rather than on individual products.

2. Operational Experimentation. Experiments are used to *develop and assess concept-based hypotheses* to identify and recommend the best value-added solutions for changes to doctrine, organizational structure, training, and education, materiel, leadership, and people required to achieve significant advances in future operational capabilities (joint and single service). One of the stated purposes of the Marine Corps Warfighting Laboratory is to "Conduct wargames and experimentation to evaluate new tactics, techniques and technologies." The technology to be evaluated via experiments may require development to a prototype or near-prototype level. MCWL presents this requirement to the Office of Naval Research where the technology may be established as a program and developed to a physical stage where it can be used by MCWL in experimentation and evaluation. In some situations, MCWL, working in conjunction with other commands and/or laboratories (DARPA, ONR, et al), may develop a technology to the near-prototype or prototype stage.

3. Innovative Naval Prototypes. INPs are disruptive technologies that, because of high risk or radical departure from established requirements and concepts of operations, are

unlikely to survive without top leadership endorsement. INP programs invest in S&T projects intended to achieve a level of maturity suitable for transition to an acquisition program within 4-8 years. INPs make significant investment in projects with high technological risks, but which offer the prospect, if successful, of being revolutionary "game changers" in Navy and Marine Corps warfighting capabilities. The governance of the INP program is provided by the DoN S&T Corporate board. The Chief of Naval Research (CNR), in consultation with other stakeholders, nominates candidates for Corporate Board approval. (Note you have not defined the Corporate Board ASN RDA, VCNO and APMC).

V. Transition of Products. The ultimate goal of DoN S&T research is to transition technology into fielded systems that will provide a combat advantage to the fleet and force. To maximize the S&T efforts, ONR has designed its research enterprise so that each level (6.1/6.2/6.3) provides S&T products to the next level for refinement in a smooth, linear, efficient progression. The transition of products is accomplished through the combined efforts of MCCDC, ONR, MCSC, and the Program Executive Officer for Land Systems (PEO (LS)).

VI. S&T Areas of Responsibilities. Management of S&T, from initiation of requirements to the successful transition of programs to the acquisition command, is a multi-organization effort that requires close integration and cooperation between DoN components and organizations. A primary method used to facilitate this integration and cooperation of S&T responsibilities is the S&T Integrated Product Team (IPT).

MCWL, Science & Technology Integration Division (S&TI), supports the CG, MCWL in his role as the Executive Agent for Marine Corps S&T to develop the vision, policies, and strategies needed to exploit scientific research and technological development.

The primary organization in the Naval Research Enterprise (NRE) responsible for the planning, execution and day-to-day oversight of Marine Corps S&T programs is the Deputy CNR and Department Head, Expeditionary Warfare and Combating Terrorism S&T Department (Code 30), Office of Naval Research headquartered in Arlington, VA.

A. MCWL (S&TI)

1. Mission. The mission of MCWL (S&TI) is to integrate and focus S&T efforts and coordinate the Marine Corps S&T process in order to enhance the warfighting capabilities of every Marine.

2. Roles and Tasks

- a. Act as the S&T Operations Office for the Marine Corps
- b. Integrator/Coordinator of Marine Corps Systems Command, PEO (LS), Office of Naval Research, MCCDC (Capabilities Development Directorate (CDD)), and the Marine Corps Warfighting Lab in regard to S&T issues
- c. Integrator of the Marine Corps S&T (requirements and STOs) involvement across all Services; including coordination of Marine Corps S&T requirements

process among MCSC, PEO (LS), ONR, CDD, Operating Forces, Advocates, the Future Naval Capabilities (FNC) and the Innovative Naval Prototypes (INPs)

d. Marine Corps representative to the Department of Defense Joint Capabilities Technology Demonstration (JCTD) Program

e. Conduit for Marine Forces Pacific and Marine Forces Atlantic Naval Science Advisors and Marine Expeditionary Force Liaison Officers into the Marine Corps S&T Process.

f. Provide S&T investment strategy data to the EA S&T

g. Articulate Marine Corps S&T needs to industry, academia, and other service/national labs

h. Represent Marine Corps S&T interests & coordinate input to: JCTDs; Defense Science Board (DSB); Joint Non-Lethal Weapons Directorate (JNLWD) Technology Investment Panel; Joint Requirements Panel (JRP), Joint Requirements Board (JRB) and Joint Requirements Oversight Council (JROC)

B. ONR (Code 30). This is the principal agency within the DoN for planning, execution and oversight of Marine Corps S&T programs. Its members represent the Marine Corps throughout the departments within ONR, and work closely with the MCWL, MCSC, PEO (LS), MCCDC (CDD), and OPNAV “resource sponsors.” Code 30 supports the DC CD&I, whose responsibility it is to ensure that Marine Corps S&T resources are aligned with requirements, and support smooth transition into acquisition programs of record which answer operational needs. Understanding Marine Corps S&T and its process requires an understanding of the structure of ONR and Code 30.

ONR is organized into six separate departments (See Figure 1). Within each department are Future Naval Capabilities (FNC) and INPs, as well as Discovery and Invention (D&I) programs. Each FNC is directed by an Integrated Product Team (IPT) that addresses the perspective of all the following stakeholders: Requirements, Acquisition, Science and Technology, Resource Sponsor, and Operating Forces.

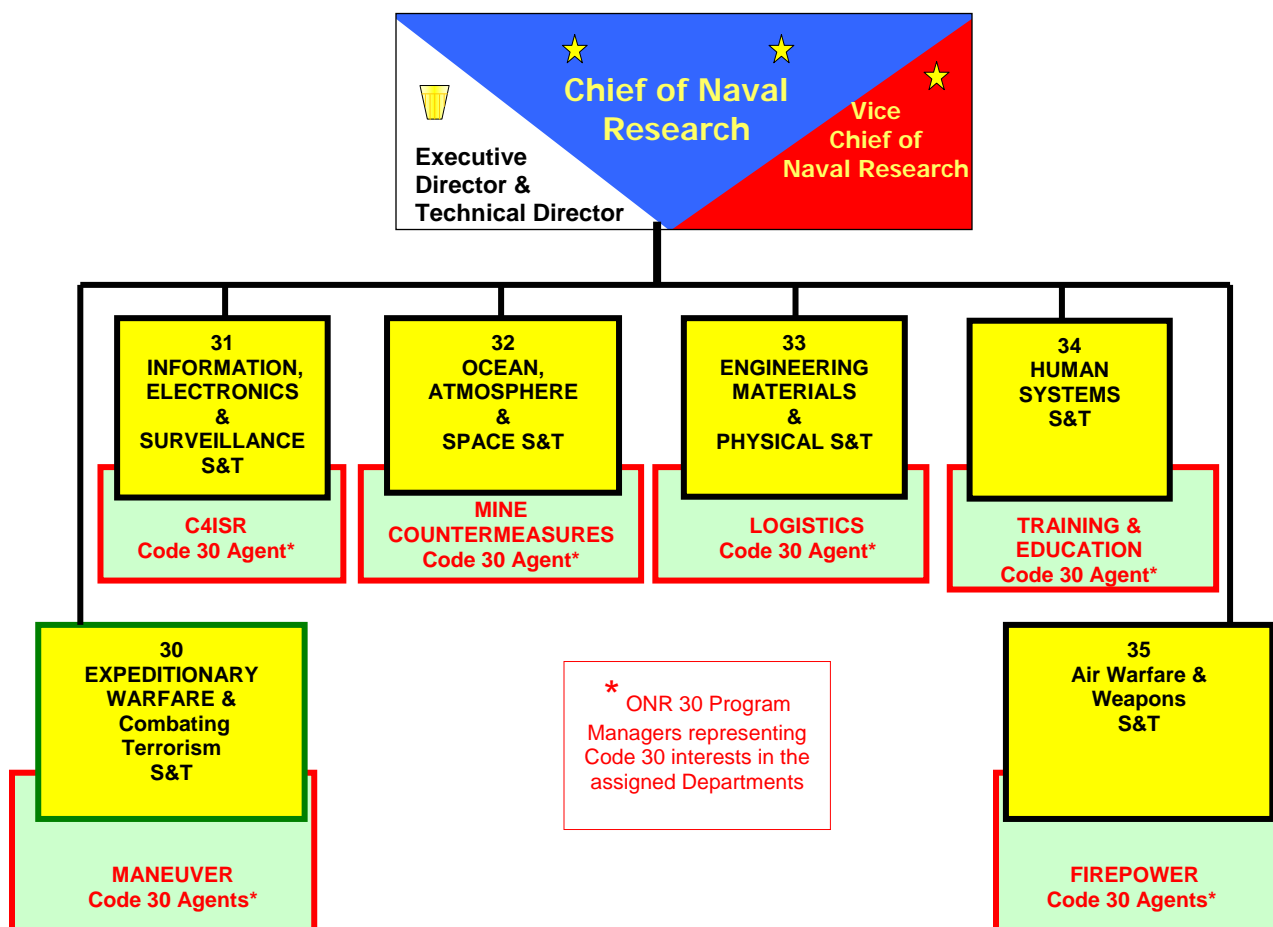


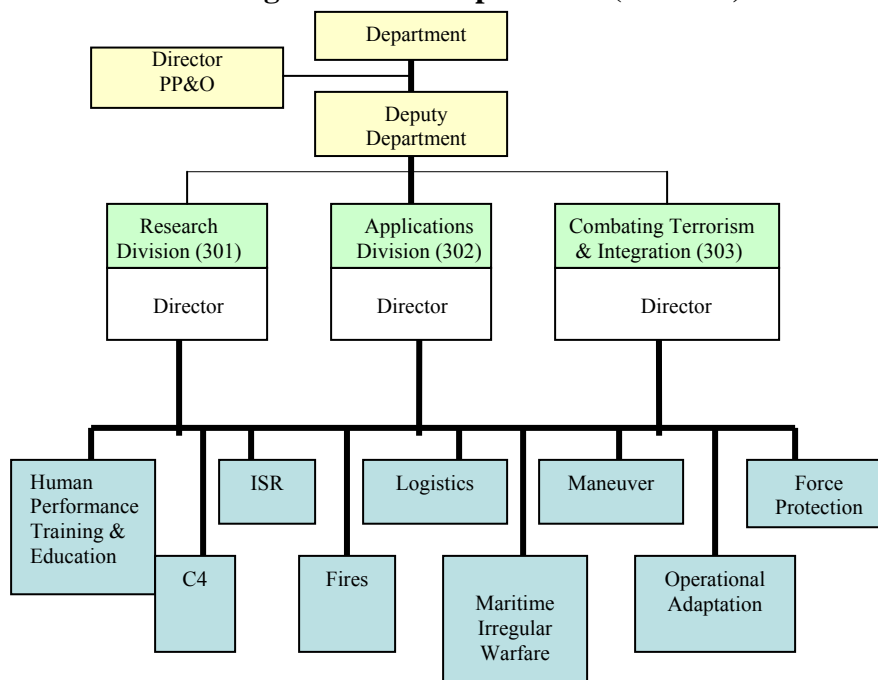
Figure 1: ONR Structure

A Research Division within each department is responsible for Basic Research (6.1) along with approximately one half of Advanced Research (6.2). Applications Divisions in each department are responsible for executing the balance of the Advanced Research (6.2) and Advanced Technology (6.3).

ONR Code 30 is organized as depicted in Figure 2. Each of the nine Thrust Areas: Human Performance/Training and Education, C4, ISR, Fires, Logistics, Maritime Irregular Warfare, Maneuver, Operational Adaptation, and Force Protection are designed and staffed to develop and leverage Research, Applied Research, and Advanced Technologies for application. The Department funds and manages a wide array of aggressive projects to ensure Marine Corps access to leading edge S&T. Each Thrust Area is managed by a Program Manager (PM), who also participates as a core team member within each of the other ONR Departments, respectively. Project officers are responsible for advising their respective ONR department on Marine Corps missions and requirements, and ensuring that Marine programs are coordinated and aligned

throughout ONR. These PMs also perform a similar function with regards to Navy Technology programs in support of ONR code 30's broader naval mission.

**Figure 2: Expeditionary Maneuver Warfare
&
Combating Terrorism Department (Code 30)**



C. Marine Corps S&T IPT. The EA for S&T uses the Marine Corps S&T IPT as the forum to facilitate his responsibilities. The Department Head, ONR Code 30, representing the Naval Research Enterprise, acts as the Chair of the IPT. The Technical Director of MCWL acts as the Executive Secretary for the S&T IPT. The IPT consists of the Assistant VCNR and representatives from MCCDC (MCWL, TECOM, and CDD), MCSC, PEO (LS), ONR, OPNAV, and HQMC Advocates. The Marine Corps S&T IPT meets semi-annually and can schedule ad hoc meetings to address issues that are deemed of importance or those that are time critical. The S&T IPT appoints subordinate Working Groups and sub-IPTs to perform specific tasks. These working groups receive tasks as required by the S&T IPT and report back with their findings and recommendations.

VII. Other Participating Organizations. As indicated in Table 1, responsibilities pertinent to the S&T Program are executed in two separate organizations: Marine Corps components and Navy components. Marine components are responsible for the S&T Strategy, Requirements Generation, and Warfighting Experimentation. Navy components hold primary responsibility for the execution of individual S&T programs (excluding MCWL experimentation). Table 1 provides a summary listing of participating organizations and their corresponding Marine Corps S&T responsibilities.

Table 1: Participating Organizations and S&T Responsibilities

Organization	Responsibilities
DDR&E -- DUSD (A&T)	<ul style="list-style-type: none"> • Oversight and strategy for DoD S&T
ASN (RDA)	<ul style="list-style-type: none"> • Oversight of DoN S&T, RDT&E, and Procurement programs • SAE • Approve Below-Threshold Reprogrammings (BTR) greater than \$500K
CNR	<ul style="list-style-type: none"> • Statutory responsibility for planning and executing Basic Research, Applied Research, and Advanced Technology programs for the DoN
DC CD&I	<ul style="list-style-type: none"> • Responsible for the guidance and oversight of the Marine Corps RDT&E Program which includes S&T • Programs Marine Corps resources as lead for the WF PEB • Document Marine Corps requirements • Originate and publish Concepts and Doctrine • Draft/revise Marine Corps S&T Strategy
CG MCWL	<ul style="list-style-type: none"> • Establishes and coordinates the Marine Corps S&T process as the EA S&T • Conduct experiments and confirm concepts • Develop tactics, techniques, and procedures (TTP) • Application of technology to warfighting
ONR (C30)	<ul style="list-style-type: none"> • Develops technology • Conceives, plans, organizes, and directs S&T 6.1/6.2/6.3 programs for the Marine Corps • Conducts technical and programmatic reviews of Marine Corps S&T Programs • Develops Marine Corps S&T POM as part of the WF PEB
DC P&R	<ul style="list-style-type: none"> • Submits Marine Corps input to DoN / DoD POM
N091	<ul style="list-style-type: none"> • Navy S&T Resource Sponsor • Document Navy requirements • POM/SPP submission • Develops and submits ONR's SPP to N-8
CG MCSC and PEO (LS)	<ul style="list-style-type: none"> • Transition programs for acquisition • Exploit technology for acquisition • Execute 6.4 funds in the development of systems
MROC and PRG	<ul style="list-style-type: none"> • Approve requirements and resources

PART II: MISSIONS/ROLES/FUNCTIONS

The purpose of Part II is not to describe a formalized Marine Corps S&T process from a process-centric perspective but to provide information on the missions, roles and functions of organizations participating in the conduct of Marine Corps S&T. This information will serve in assisting and guiding incoming MCCDC, MCSC, and ONR personnel in the execution of their responsibilities.

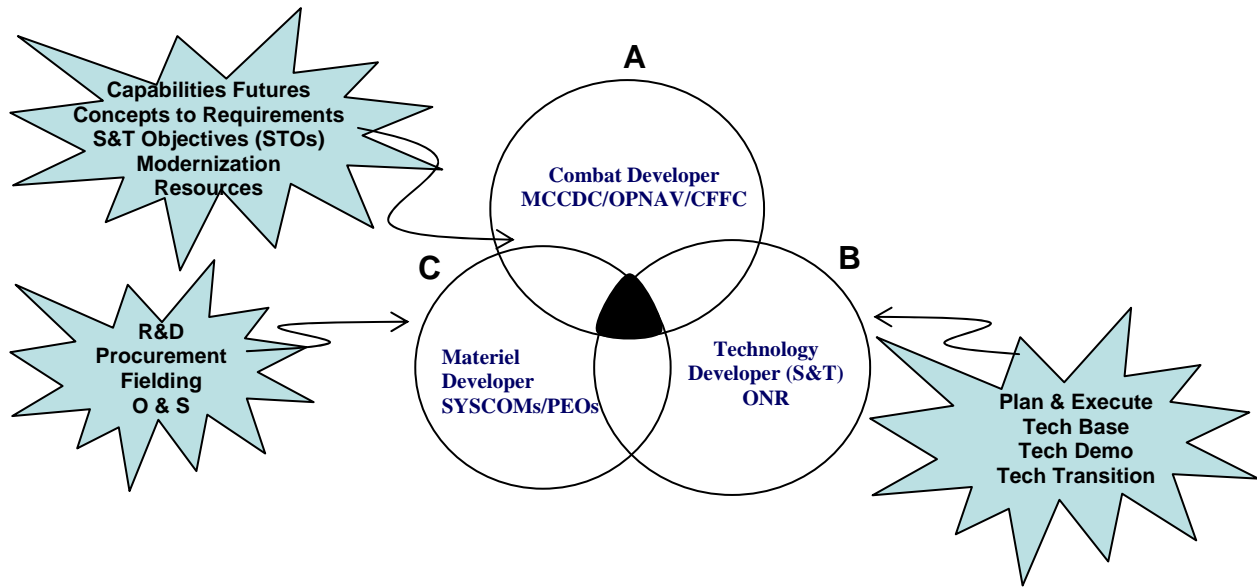


Figure 3: Collaborative Environment

Marine Corps S&T is a major component of the Naval Research Enterprise. The focus of the execution of Marine Corps S&T is the totality of actions taken to bring a weapon system or tactic, technique, and procedure (TTP) from concept to Program of Record transition, or as appropriate, incorporation into doctrine.

I. Process Owners

Table 2: S&T Process Owners

Process Segment	Owner
Guidance and Requirements	MCCDC and Advocates through the MROC (CD&I, TECOM, MCWL)
S&T Strategic Plan	MCCDC (MCWL)
S&T Investment Plan	S&T IPT (Approval: CG, MCWL and ONR (Code 30))
Resources	MROC, DC P&R, PRG, DC CD&I, ONR30
Execution	ONR (Code 30) and MCWL (Experimentation)
Assessment	S&T IPT
Transition	ONR (Code 30) and MCSC
Execution of 6.4	MCSC and PEO (LS)

II. Marine Corps S&T Goals

- The encouragement, promotion, planning, initiation, execution and coordination of Marine Corps Research and Technology development
- Providing technology opportunities and support of Marine Corps future concepts
- The readiness for transition of technology to Marine Corps acquisition
- The maintenance of technological superiority for our Operating forces
- The protection against technological surprise
- The effective application of experimentation to support the insertion of emerging technology

III. Marine Corps S&T Functions Figure 4 (next page) depicts a functional breakdown of the S&T process.

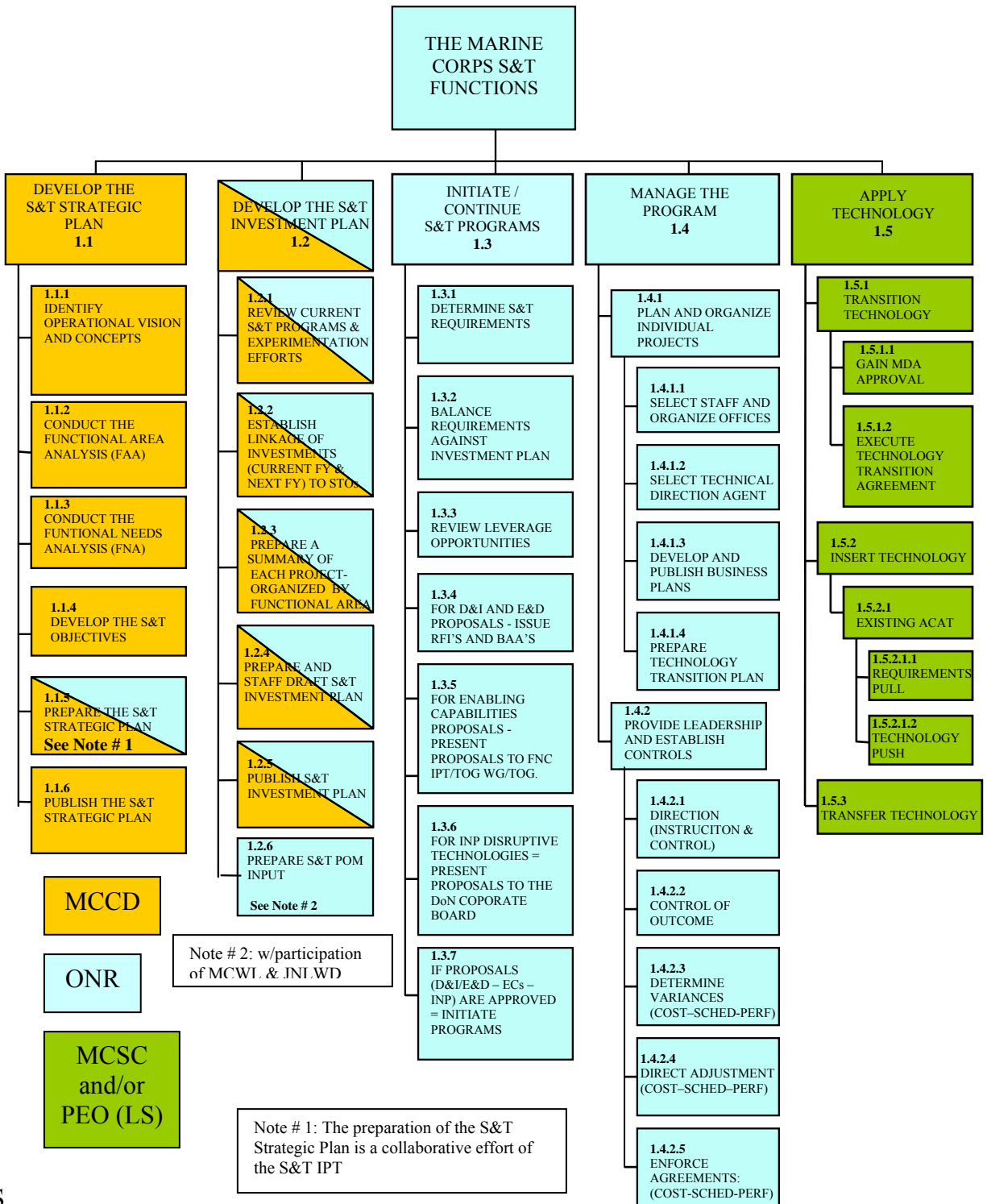


Figure 4: Marine Corps S&T Functions

A. Develop the S&T Strategic Plan. The initiation of Marine Corps S&T functions is the development of an S&T Strategic Plan. The process for developing the Strategic Plan is intensive, time consuming, and requires close interaction with DC CD&I, MCSC, PEO (LS), ONR and other services and DOD agencies. The Marine Corps Strategic Plan is an integral part of the Defense Science & Technology Strategy and the Naval S&T Strategic Plan.

The process for developing the Strategic Plan is integrated with the Marine Corps Expeditionary Force Development System (EFDS) that generates force capabilities and warfighting. The initiation for both processes, Strategic Plan and the EFDS, begins with the Functional Area Analysis (FAA).

The MCCDC Strategic Review Group (SRG) (leading agency is Concepts Division, MCWL) initiates the FAA by conducting analyses of national strategies, Joint, Naval and Marine Corps concepts, other strategic documents, global potential adversary capabilities, and application of lessons learned **to identify capabilities, tasks, metrics and attributes**.

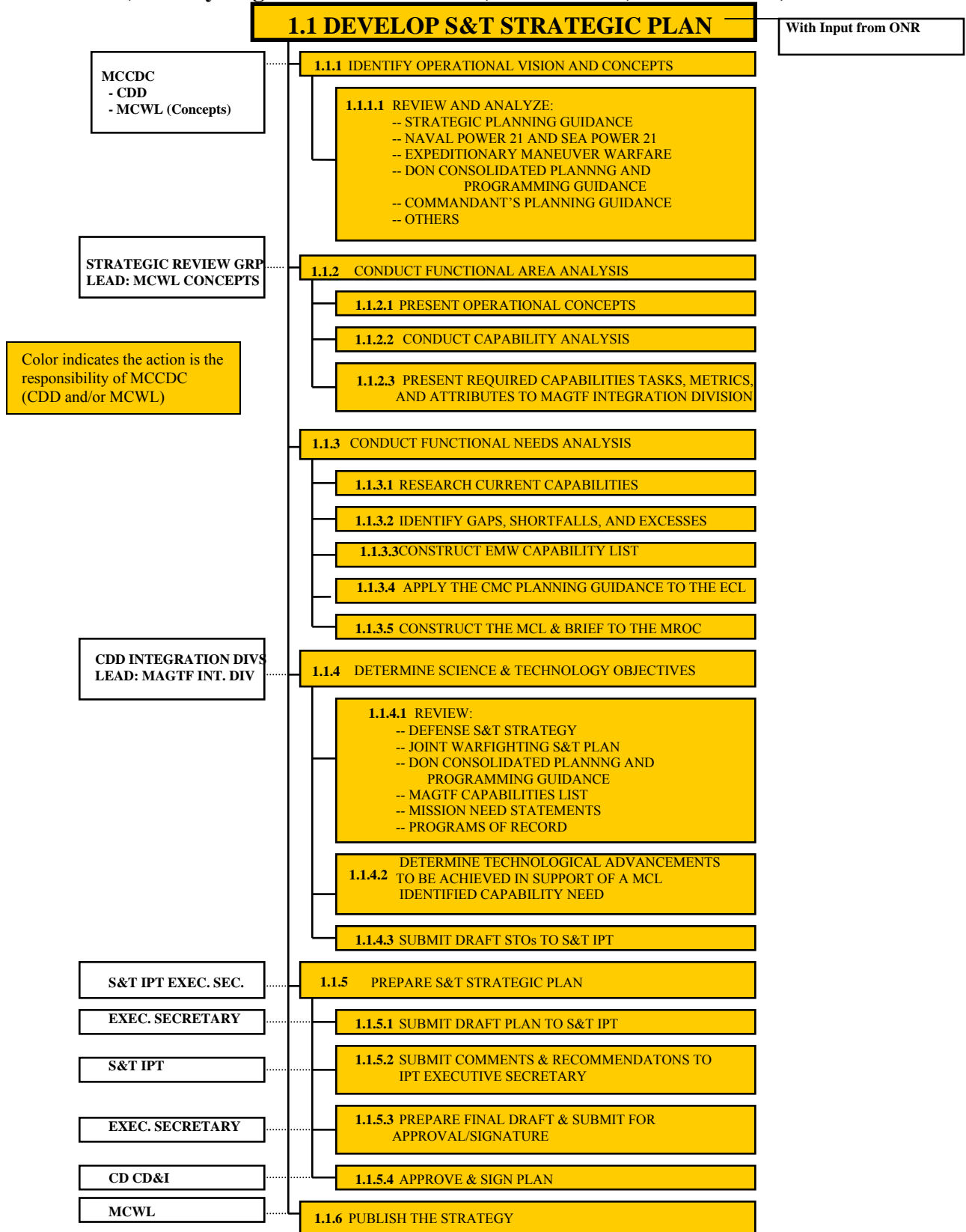
The MAGTF Integration Division (MID), MCCDC, as the lead of the Functional Needs Analysis (FNA) team, uses the primary products of the FAA as a basis for analysis to identify gaps in required capabilities and to determine shortfalls and excesses. The identified data is used by the FNA team to construct the MAGTF Capability List (MCL).

The MCL is a prioritized list of warfighting gaps and shortfalls and provides the execution, guidance and direction to achieve Marine Corps goals in the near, mid, and far term. The warfighting gaps listed in the MCL provide the basis for the S&T Objectives (STO) presented in the Marine Corps S&T Strategic Plan.

After the MROC approves the MCL, the MID will review the capability gaps and shortfalls and derive the initial STOs. STOs are established to provide combat development guidance to the S&T community, primarily the NRE but also other Services, defense agencies, industry, and academia. A STO states a major technological advancement to be achieved and is in support of a capability need identified by the MCL.

The S&T IPT using the STOs, along with input from MCWL, ONR, and industry, will identify on-going programs and technologies to determine which requirements are currently being addressed and which require additional effort. Based on this information the IPT, with ONR acting as the Chair and MCWL acting Executive Secretary, will construct the S&T Strategic Plan. The plan is staffed for comments, inputs, and concurrence to the organizations represented on the S&T IPT. It is published on a 24 month cycle and is signed by DC, CD&I.

Figure 5: S&T Function 1.1
(Primary Organizations: MCCDC (CDD/MCWL) and S&T IPT)

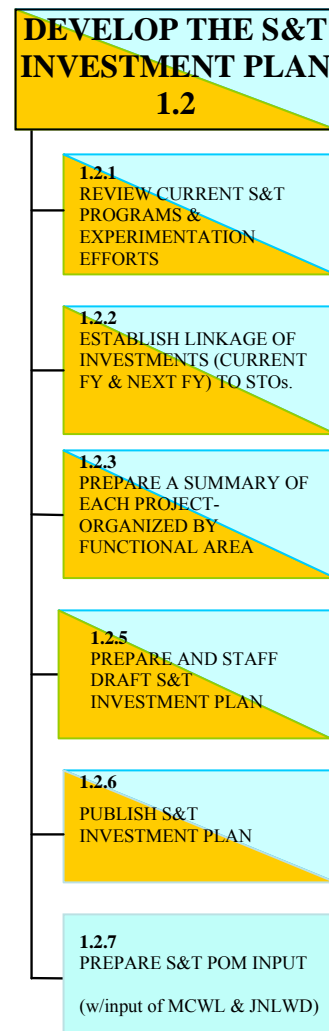


B. Develop the Marine Corps S&T Investment Plan (Function 1.2). The Investment Plan is developed by MCWL (S&TI) in conjunction with ONR (Code 30). It is a Marine Corps reference and planning document for decision makers and users at all levels. Based on the S&T Strategic Plan, and the Experimental Campaign Plan, the Marine Corps S&T Investment Plan illustrates S&T resource allocation, from a general overview level, where users can see how resources are allocated. The CG MCWL, and the ONR Department Head Expeditionary Warfare and Combating Terrorism (Code 30), update and promulgate the Marine Corps S&T Investment Plan annually. The Principal customers for this plan are the DC CD&I, CG MCSC, and PEO (LS).

The Investment Plan describes the Marine Corps investment in specific S&T and Operational Experimentation efforts and how they are employed to most effectively meet Marine Corps combat development objectives. It shows the linkages of planned technology investments in the current fiscal year (FY), and as projected in the next FY, to the S&T Objectives (STOs) as identified in the Marine Corps Science and Technology Strategic Plan.

The Investment Plan is divided into two sections. The first section provides an overview of the Naval Research Enterprise. The second section provides a summary of each project resourced by Marine Corps S&T – both at ONR and at MCWL – organized by functional area.

**Figure 6: S&T Function 1.2
(Primary Organizations: MCWL / ONR)**



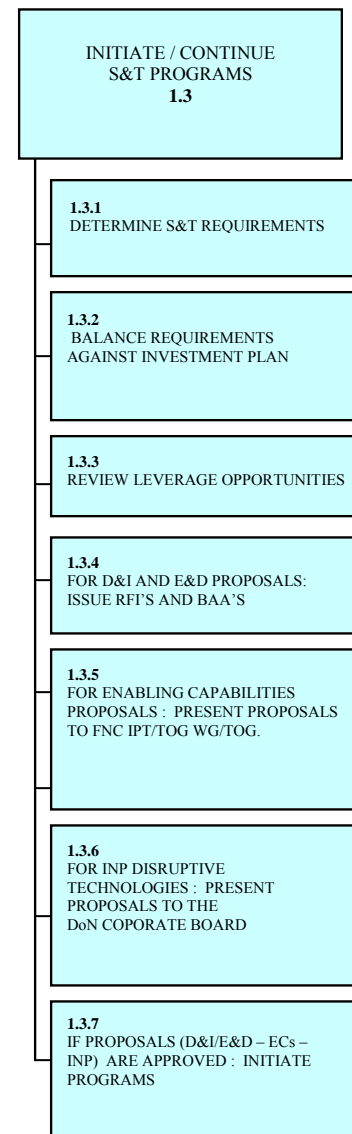
C. Initiate / Continue S&T Programs. S&T programs are initiated in response to Marine Corps needs / requirements. Primarily, investments (6.2/6.3) are made in response to Science & Technology Objectives as stated in the S&T Strategic Plan. As previously stated the STOs are derived from the capability gaps depicted in the MCL. However, there are multiple sources of requirements and required programs.

The determination of Marine Corps S&T requirements is, actually, a continuous process. The requirements are determined from the following primary sources:

- MAGTF Capability List and S&T Strategic Plan and OPNAV N81 Capability Gap Process (Requirements Push)
- Universal Need Statement (UNS) (Requirements Push)
- Experimentation
- ONR Discovery and Invention / Exploitation & Deployment
- Modification/Improvement to an acquisition Program of Record (POR) (Requirements Push - Technology Pull)

1. MAGTF Capability List / S&T Strategic Plan and OPNAV N81 Capability Gap Process. Throughout the process for the determination of Marine Corps capability gaps, MCCDC (CDD) integrates their efforts and results with the OPNAV N81 gap analysis process. N81 has established an operational gap analysis process that is integrated with the ONR's Future Naval Capability (6.3 funds) program. The N81 process consists of wargaming multiple scenarios, developing Mission Capability Packages, and then defining the capability gaps within each of the packages. CDD, using the MCL and Strategic Plan as the process basis, participates as an integral part of the N81 process.

Figure 7: S&T Function 1.3



After determination of the gaps, each current Future Naval Capability (FNC) program is analyzed to determine if that particular program supports a genuine need. If not, the program is cancelled. If a gap is not being answered sufficiently by current programs, a new effort, called an "Enabling Capability" (EC) is proposed. The current programs, cancelled programs, and proposed programs are briefed to the TOG for approval.

2. Unified Need Statement. As a UNS is completed it is forwarded to MCCDC (Capability Development Directorate) where it is assessed for validity. If valid, it is passed to the Combat Development and Integration Board (CDIB) where it will be evaluated under the Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel and Facilities (DOTMLPF) process. The CDIB will evaluate the UNS and arrive at a recommended Course of Action (COA). If the recommended COA is for development of a materiel solution and the CDIB determines that the required materiel solution is not technologically mature, the initiative will be forwarded to MCWL (S&TI), for evaluation and subsequent forwarding to the S&T IPT.

3. Experimentation. Working in collaboration with CDD, ONR, MCSC, and PEO (LS), the Lab determines those technologies required for experimentation, confirmation of concepts, development of tactics, techniques, and procedures (TTP), and application of technology to warfighting. These required technologies that are not technologically mature are presented to the S&T IPT for consideration as S&T programmatic efforts.

4. Office of Naval Research (Code 30). ONR Code 30 PMs vital knowledge and experience to the table:

- Knowledge of USMC/USN Operational Concepts - present and future
- Knowledge of prior programs and reviews;
- Knowledge of related ONR and outside programs; and
- On-hand S&T experience.

ONR Marine PMs review the S&T Strategy STOs that fall within the confines of their Department and, with their extensive corporate knowledge of current and planned DoN S&T efforts, make decisions as to where it is best to seek answers to the STOs and which type of programs (weapons systems, investigation of new or modified training, etc) are feasible. Additionally, the project officers, as managers of ongoing S&T, are cognizant of recent technology discoveries that could serve as “Technology Push.”

The ONR PMs research current and projected projects and determine the S&T areas/programs that hold the most promise for fulfilling the needs. When approved the areas/programs are forwarded to the Department Head, Code 30 for initial approval and for forwarding to the CNR for final approval.

5. Marine Corps Systems Command. The Program Managers from MCSC will submit S&T requests for materiel improvement needs to the S&T IPT for consideration. The requests will primarily be for programs that are conducted for purposes of risk reduction, technology insertion, and confirmation of system capabilities. The requirements may seek improvements to a system in development or in production.

D. Manage the Program. The management function is an extensive, repetitive function that permeates all other S&T functions. It is executed throughout ONR (Code 30) and the agencies and laboratories working in conjunction with ONR.

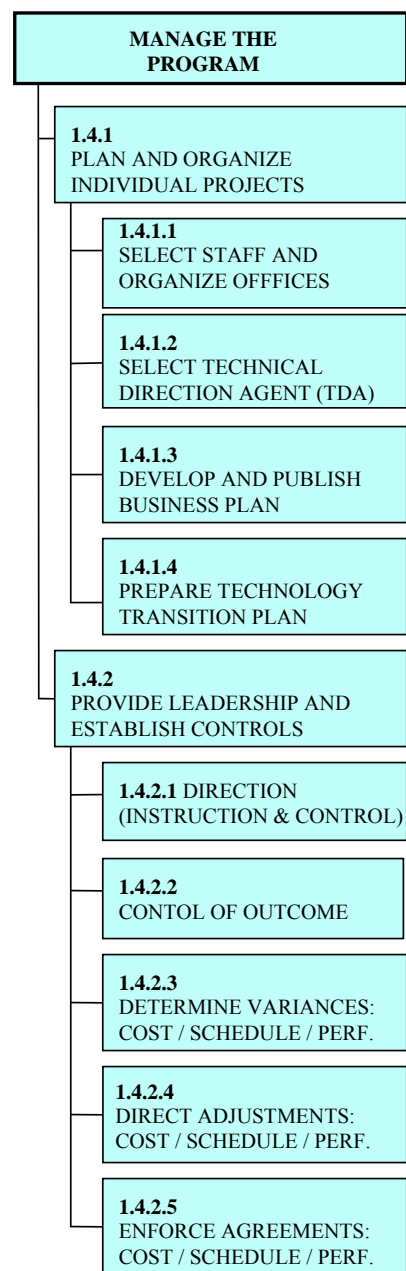
SECNAVINST 5000.2C defines a "non-acquisition" program as "...an effort that does not directly result in the acquisition of a system or equipment for operational deployment and does not require an Initial Capability Document." This definition covers the efforts undertaken by the MCWL for experimentation purposes and ONR (Code 30) efforts in D&I and E&D.

In addition to required PPBES documentation, ONR requires that each FNC write and maintain Business Plans written at the Enabling capability (EC) level. The business plan is the primary management document for Exploitation & Discovery programs. It is of particular interest throughout the chain of program responsibility and is used for management, benchmark, and financial purposes.

Updated EC Business Plans are due 1 July of each year. Funds for the upcoming fiscal year are not released until the business plan is submitted.

All FNC products require a Technology Transition Agreement (TTA). The TTA documents the commitment between the Requirements sponsor (MCCDC), S&T sponsor (the appropriate ONR Department or MCWL); and the Acquisition sponsors (MCSC and PEO LS). The agreement serves to develop, deliver and integrate a Technology / product into an acquisition program of record (POR).

Figure 8: S&T Function 1.4



Maintaining control of outcome is accomplished by staying on top of emerging problems within the program as well as the emerging changes in policies and external interests. This is done primarily through meetings, reviews and reports.

ONR requires a monthly report for each E&D program. The report must document product level performance in the form of "actual" vice "planned" costs and schedule.

A key event schedule and expenditure plan must be submitted by 1 October of each fiscal year. This plan will be used as the basis for assessing monthly progress.

Additional reviews may be held at the direction of the S&T Program Manager:

1. Design Review 1: Reviews the conceptual design of the system, to establish its capability to satisfy goals.
2. Design Review 2: Confirms that the preliminary design logically follows the DR 1 findings and meets the goals.
3. Design Review 3: Evaluates the completeness of the design, interfaces, and release for hardware fabrication.
4. Test Readiness Review: A review that verifies that the actual item is ready to be tested.
5. In-Progress Review: Presents progress report and current status of cost, schedule, and performance against the baseline.

These events provide data to use as benchmarks for progress evaluation and the variances to be used for measurements of deviation from the baseline. When obtained in a timely and regularly scheduled manner, possession of this data allows the leader to direct adjustments to the program and to insist upon the enforcement of agreements.

E. Apply Technology. The ultimate purpose is to apply the new technologies and equipment to the requirements of the Marine Corps. This is accomplished by the transition, insertion, and transfer of technology.

1. Transition Technology: The transition of a technology program into a Program of Record managed by a MCSC Program Manager.

The ONR S&T Program Manager, requirements sponsor (MCCDC), and the receiving Program Manager from MCSC or PEO LS bring about the effective transition of technology. A Working Group established by the cited representatives will ensure that the following tasks are accomplished:

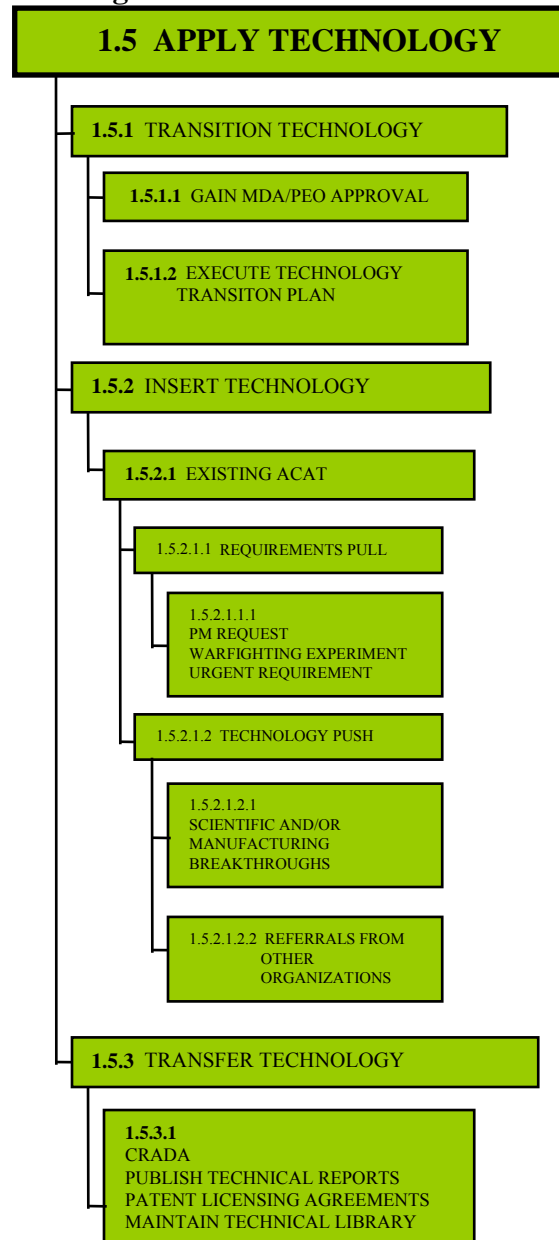
- In-process review to assess cost, schedule, and performance risk
- TIWG to review test planning (draft TEMP) and test results (DT 0/OT 0)
- Documentation review to determine status of required documentation
- Review requirements documents

After completion of the above events the transition brief is presented to the appropriate Milestone Decision Authority (MDA) (MCSC or PEO (LS)). The purpose of the meeting is to receive the MDA's approval to transition the technology program to the Acquisition Program Manager. The MDA must be convinced that:

- Risks are manageable
- Requirement documents are mature
- 6.4 or 6.5 funding is in place
- TTA goals have been met
- Program is ready to proceed into recommended acquisition phase.

With receipt of the Commander's approval, the program is transitioned to PEO (LS) or MCSC.

Figure 9: S&T Function 1.5



2. Insert Technology: The insertion of a new technology into an existing system or program. This system could be in the acquisition development process or a fielded system.

ONR develops technology but the receiving Program Manager inserts the technology. The insertion of technology into an existing system that is in the acquisition process or fully fielded can occur as a result of a requirement “pull” or a technology “push.”

Technology insertions are usually a result of a **requirement-pull** request from a Program Manager. A PM request for an ONR S&T effort could be for many reasons. The request may be seeking an answer to a technological deficiency discovered in the development of a weapon system; a correction to a problem discovered during test and evaluation, or assistance in improving a capability of a fielded system.

Other requirement-pull reasons for insertion of technology may be a result of a “warfighting experiment” or an “urgent requirement.” MCWL is chartered to conduct Limited Objective Experiments (LOE) and Advanced Warfighting Experiments (AWE). Outputs of these experiments include analysis/assessment underpinning future operational requirements. This analysis/assessment may determine that current/planned technology and/or concepts may not be able to meet warfighting objectives and that additional technological development and research is necessary in order to modify a system that is being developed.

An urgent requirement is issued by MCCDC when a threat is immediate and the capabilities of an existing system cannot meet warfighting objectives. ONR (C30) and the Acquisition PM work in conjunction with MCCDC in developing a technological capability or concept that could be incorporated into the existing system.

A **technology-push** is a scientific or manufacturing breakthrough that, if incorporated into an existing system, would increase the capabilities of that system. If an analysis indicated that incorporating the new technology into the system would be cost and operationally effective, ONR, working with the Acquisition PM, would assist in inserting the technology.

3. Transfer Technology: The movement of technology outside of the Acquisition Command. There are four major methods used to transfer technology.

a. Cooperative Research and Development Agreement (CRADA). CRADA provides for mutual technology development efforts with industry, academia, and public organizations. This allows significant leveraging of Marine Corps R&D funds, and provides commercial opportunities for industry and academia.

b. Publishing Technical Reports. The publication and distribution of reports explaining the type of development; the methods and processes used and the resultant findings and discoveries.

c. Patent Licensing Agreement (PLA). The licensing of government-development assets or technologies for use by industry or academia. The Chief of Naval Research (CNR) is the Patent Officer for the DoN.

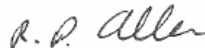
d. Maintain Technical Libraries. The installation and upkeep of libraries dedicated to the dissemination of information relevant to the development of technology. The Naval Research Laboratory (NRL) has responsibility for maintaining the DoN's primary technical library.

PREFACE

The Marine Corps develops and executes a Science and Technology (S&T) Program designed to provide technologies that enable the Marine Corps of the future, but retains enough flexibility to also enhance near-term Marine Corps warfighting capabilities. An objective of the S&T program is to develop the technologies necessary to provide Marine Forces with the capabilities to perform those specified and implied missions assigned by law. An additional objective is to present the Combat Development Process with technology opportunities which define the "Art of the Possible." The technology is then available for fielding in order to meet the requirements of the Expeditionary Force Development System (EFDS).

The process for developing the Marine Corps S&T Strategic Plan is integrated with the EFDS. The objectives of the Strategic Plan are driven by the Marine Air-Ground Task Force (MAGTF) Capabilities List (MCL). The MCL is a prioritized list of warfighting gaps and shortfalls and provides the execution, guidance and direction to achieve the goals of the Marine Corps in the near, mid, and far term. The warfighting gaps listed in the MCL provide the basis for the S&T Objectives (STO) presented in the Marine Corps Strategic Plan. The S&T Integrated Process Team (IPT), using the STOs, along with input from the Marine Corps Warfighting Laboratory (MCWL), Office of Naval Research (ONR), Marine Corps Systems Command (MCSC), Marine Corps Program Executive Officer for Land Systems (PEO (LS)), and industry, will identify on-going programs and technologies to determine which requirements are currently being addressed and which require either additional effort, or initiation of S&T development. Based on this information, the IPT will formulate the S&T Strategic Plan. This process educates the Marine Corps S&T program and helps ensure we apply our scarce resources to develop the appropriate technologies for the Marine of tomorrow.

This Handbook has been developed jointly by the Marine Corps Warfighting Laboratory and the Office of Naval Research (ONR 30) *as a guide* for personnel assigned responsibilities relevant to Marine Corps Science and Technology. Inquiries regarding this Handbook should be addressed to the Commander, MCWL (Technology Director) Quantico, Virginia 22134-5096



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